In the Claims

The following listing of the claims replaces all previous listings.

1. (Previously Presented) A method for producing an optical watermark on a document, the method including:

a) determining a required plural number of watermark layers and a dot pattern for each watermark layer, the dot pattern having a fixed frequency for each direction in the dot pattern;

b) selecting at least one latent image object for each watermark layer

c) modulating a phase of the dot pattern to embed each latent image object into its respective watermark layer;

d) superposing the watermark layers to form the watermark;

e) defining and generating a decoder for each watermark layer, the decoder matching a phase unmodulated dot pattern of each corresponding watermark layer; and

f) applying the optical watermark to the document;

wherein the decoder is used to decode the at least one latent image object for each watermark layer.

2. (Previously Presented) The method of claim 1, wherein the dot pattern for each watermark layer is a pattern defined on a two dimensional digital image plane.

3. (Original) The method of claim 2, wherein the dot pattern is a basic two-dimensional dot array.

4. (Original) The method of claim 2, wherein the dot pattern is a linear coordinate mapping of a basic two-dimensional dot array.

5. (Original) The method of claim 2, wherein the dot pattern also includes a non-linear coordinate mapping of a basic two-dimensional dot array.

6. (Canceled)

7. (Original) The method of claim 2, wherein the dot pattern is a result of a set of operations on a set of basic and other types of two-dimensional dot arrays.

8. (Previously Presented) The method of claim 1, wherein the latent image objects contain information which is critical to an application.

9. (Original) The method of claim 8, wherein the information is from the group consisting of: copy, void, a critical name, and a number from the document.

10. (Canceled)

11. (Canceled)

12. (Previously Presented) The method of claim 1, wherein the phase modulation includes a post-processing to smooth any abrupt phase changes along the edges of the latent image object.

13. (Original) The method of claim 1, wherein the decoder has a decoder structure related to a dot pattern structure of a carrier dot pattern of the watermark layer and in the direction where the latent image object is embedded.

14. (Original) The method of claim 13, wherein the relationship is selected from the group consisting of: the same, and conjunct.

15. (Previously Presented) The method of claim 1, wherein after modulation the watermark layer and its decoder each carries part of the information of the latent image object which is generated based on the latent image object and a random function.

16. (Previously Presented) The method of claim 1, wherein the watermark layers are different from each other and are of sufficient difference to avoid interference between them as a result of them being superimposed.

17. (Original) The method of claim 13, wherein one of the watermark layers is a counterfeit-proof layer, the decoder for which is a photocopier.

18. (Original) The method of claim 17, wherein after the superposition of the watermark layers with the counterfeit-proof layer there is included a post-processing step to remove dots which are too close to adjacent dots in a non-object area.

19. (Previously Presented) The method of claim 1, wherein the method is included in a method for printing a document for protection and authentication, the method further including:

a) verifying the authenticity and copyright of the document before printing;

b) generating the watermark according to the method of claim 1;

c) controlling the printing process to protect the document and the watermark from attack; and

d) generating the decoder device and distributing the decoder device to enable verification of the authenticity of the document.

20. (Original) The method of claim 1, wherein the watermark is extended to colour documents.

21. (Original) The method of claim 20, wherein the watermark layers are in different colour channels in various colour spaces.

22. (Original) The method of claim 21, wherein colour spaces CMY/CMYK, HIS, XYA, YUV and RGB are used.

23. (Currently Amended) ~~A tangible~~ An optical watermark ~~for use on~~ incorporated into a document, the watermark having:

a) a required plural number of watermark layers, each of the plural number of watermark layers each being a dot pattern, the dot pattern having a fixed frequency for each direction in the dot pattern;

b) at least one latent image object embedded into each watermark layer by modulating a phase of the dot pattern; and

c) the watermark layers being superposed to form the watermark;

wherein a decoder for each watermark layer matches ~~the~~ a phase unmodulated dot pattern of each watermark to decode the at least one latent image object for each watermark layer.

24. (Original) The watermark of claim 23, wherein the dot pattern for each watermark layer is a dot pattern defined on a two dimensional digital image plane.

25. (Original) The watermark of claim 24, wherein the dot pattern is a basic two-dimensional dot array.

26. (Original) The watermark of claim 24, wherein said dot pattern for the watermark is a linear coordinate mapping of a basic two-dimensional dot array.

27. (Original) The watermark of claim 26, wherein the dot pattern also includes a non-linear coordinate mapping of a basic two-dimensional dot array.

28. (Canceled)

29. (Original) The watermark of claim 24, wherein the dot pattern is a result of a set of operations on a set of basic and other types of two-dimensional dot arrays.

30. (Previously Presented) The watermark of claim 22, wherein the latent image objects contain information which is critical to an application.

31. (Original) The watermark of claim 30, wherein the information is from the group consisting of: copy, void, a critical name, and a number from the document.

32. (Canceled)

33. (Canceled)

34. (Previously Presented) The watermark of claim 23, wherein any abrupt phase changes along the edges of the latent image object are smoothed.

35. (Previously Presented) The watermark of claim 23, wherein a decoder is provided for each watermark layer which has a decoder structure related to a dot pattern structure of a carrier dot pattern of the relevant watermark layer and in the direction where the latent image object is embedded.

36. (Original) The watermark of claim 35, wherein the relationship is selected from the group consisting of: the same, and conjunct.

37. (Original) The watermark of claim 35, wherein after modulation the watermark layer and its decoder each carries part of the information of the latent image object which is generated based on the latent image object and a random function.

38. (Previously Presented) The watermark of claim 23, wherein the watermark layers are from each other and are of sufficient difference to avoid interference between them as a result of them being superimposed.

39. (Original) The watermark of claim 35, wherein one of the watermark layers is a counterfeit-proof layer, the decoder for which is a photocopier.

40. (Original) The watermark of claim 39, wherein after superposition of the watermark layers with the counterfeit-proof layer dots which are too close to adjacent dots in a non-object area are removed.

41. (Previously Presented) The watermark of claim 23, wherein the watermark is included on or in a document for protection and authentication.

42. (Original) The watermark of claim 41, wherein the watermark is included on or in the document as a device selected from the group consisting of: background, seal, logo, graphic device, trade mark and a word.

43. (Original) The watermark of claim 23, wherein the watermark is coloured.

44. (Original) The watermark as claimed in claim 43, wherein the watermark layers are in different colour channels in various colour spaces.

45. (Original) The watermark as claimed in claim 44, wherein colour spaces CMY/CMYK, HIS, XYZ, YUV and RGB are used.